Draft Executive Summary
Version of 6/17/19

Overview

The *San Francisco Bay Area Seaport Plan* (Seaport Plan), prepared by the San Francisco Bay Conservation and Development Commission (BCDC), guides the development and use of the Bay Area's seaport land. The Seaport Plan focuses on the lands designated for "port priority use" in the *San Francisco Bay Plan*. The general goal of the Seaport Plan is to ensure that the Bay Area retains sufficient seaport capacity to serve its foreseeable waterborne cargo needs. The Seaport Plan covers five generic cargo types:

- Containerized cargo
- Roll-on/Roll-off (ro-ro) cargo (formerly classified as "neo-bulk")
- Dry bulk cargo
- Break-bulk cargo (not currently handled)
- Non-petroleum liquid bulk cargo

The composition of SF Bay Area cargo flows has changed over time, and will continue to shift in response to demand, trade conditions, and competitive alternatives. Exhibit 1 shows the commodities moving through Bay Area ports as of early 2019.

Exhibit 1: Current 2019 Bay Area Cargo Flows

Commodity	Seaport Plan Public Ports					Private Terminals	
	Oakland	Richmond	Benicia	Redwood City	San Francisco	Levin Richmond	Others
Containerized Imports	X						
Containerized Exports	X						
Containerized Domestic IB	X						
Containerized Domestic OB	X						
Import Autos		X	X		X		
Export Autos		X	X		X		
Export Scrap Metal	X[1]			X		X[2]	
Import Veg Oils		X					
Import Chemicals							X
Import Gypsum				X			X
Import Cement				X	X		
Export Pet Coke			X			X	
Export Coal						X	
Import Sand & Gravel				X	X		X
Harvested Bay Sand				X	X		
Import Slag				X			
Import Bauxite				X			

(1) Schnitzer Steel (2) From SIMS Richmond

This report provides 30-year forecasts for the relevant cargo types, and a high-level review of marine terminal capacity and expansion outlook. Future volume through Bay Area seaports will be determined by economic activity in the Bay Area itself, and in the broader Central and Northern California market. Available near-term forecasts identified in this section share a common view that the pace of growth in California over the coming three to five years will be at a reduced pace, and that the West Coast in general will grow at a slower pace than the rest of the nation. The limited number of long-term forecasts available tend to focus on population, and depict steady growth over the long term, but at a slower rate than previously seen in California.

Containerized Cargo

The previous containerized cargo forecasts prepared for BCDC were developed by Tioga in 2009 to assist BCDC in evaluating the proposed use of Richmond's Port Potrero site for ro-ro cargo rather than for containers. That forecast was prepared toward the end of the 2008-2009 recession, and reflected widespread expectations for a relatively strong recovery. Post-recovery trade growth deviated from those expectations.

Container Cargo Forecast. The international TEU forecasts for imports and exports are driven by projections of economic growth developed by Moody's and Caltrans, including sub-components of national-level Gross Domestic Product, industrial output, and Gross Metro Product. The moderate growth scenario assumes that:

- Trade disputes are resolved, and most trade flows return to their recent growth patterns;
- Exporters affected by trade disputes either regain those former markets or find new markets;
- Long term exports rebound as foreign markets recover economically;
- Refrigerated container trade grows due to the development of the recently completed Cool Port facility at the Port of Oakland; and
- Imports of automobile parts increase as Tesla increases production.

Exhibit 2 shows the elements of the moderate growth container cargo forecast. The slow growth and strong growth scenarios have alternative assumptions documented in the report. The empty TEU forecast is built upon the loaded TEU forecast and the concept that the volume of empty containers is related to the volume of loaded containers moving in the opposite direction. Domestic container volumes between the Port of Oakland and Hawaii are more opaque, and likely are driven primarily by market share shifts than economic growth.

Exhibit 2: Port of Oakland Moderate Growth Containerized TEU Forecast, 2010-2050

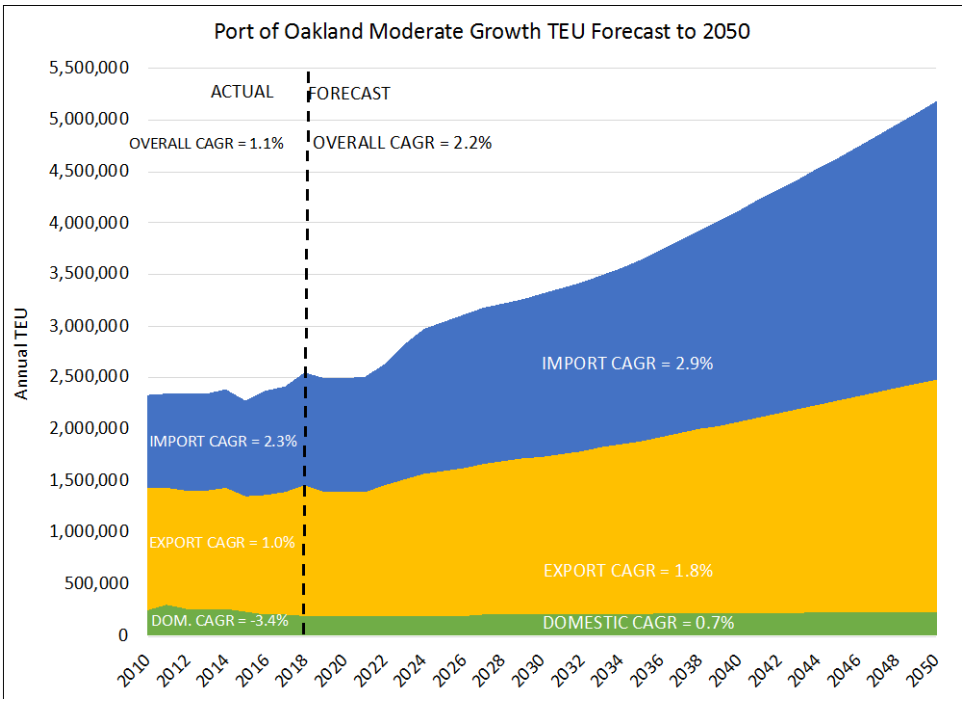
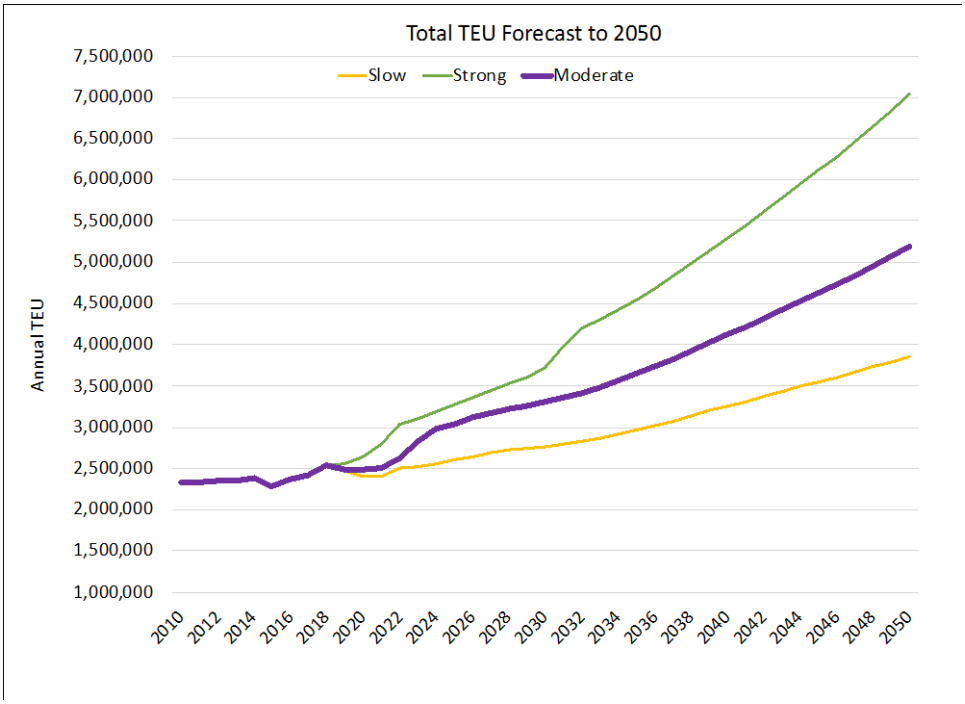


Exhibit 3 displays the three TEU forecast scenarios.

Exhibit 3: Total TEU Forecast to 2050



Container Terminal Capacity. Exhibit 4 shows the Port of Oakland's acreage in terminals and major off-dock parcels. The post-electrification acreages allow a two-acre battery exchange complex or equivalent to support zero-emissions container handling equipment.

Exhibit 4: Port of Oakland Terminals and Acreages

Terminal	Acres	2019 Acres in Use	Available Acres	Build-out Acres	Post-Electrification Acres
Ben Nutter	77	77	0	97	95
Berths 33-34	20		20		
OICT 55-56	120	120	0		
OICT 57-58	150	150	0	290	288
OICT 60	20	20	0		
TraPac	123	123	0	123	121
Matson	75	75	0	95	93
Roundhouse	20		20		
OHT Berths 20-24	150		150	150	148
Howard	50		50	50	48
Subtotal	**805**	**565**	**240**	**805**	**196**
Off-Dock	126	30	96	0	0
Total	**931**	**595**	**336**	**805**	**196**

The consultant team estimated maximum current capacity at 6,061 annual TEU per acre based on current OICT performance, and long-term capacity at 7,112 annual TEU per acre based on achieving high productivity in line with industry benchmarks. Container terminals can be expected to expand horizontally where possible, and then invest in productivity improvements to accommodate further cargo growth.

Ancillary Service Needs. As of early 2019, there were approximately 314 acres of land in the immediate Port area either already in an ancillary use (e.g. Cool Port or the two facilities on Union Pacific Land); under development for an ancillary use (e.g. Center Point Phase 1 or Prologis Buildings 2 and 3); or available for long-term ancillary use. Estimated acres required for all ancillary uses range from 167 in the slow growth scenario to 269 in the strong growth scenario. These comparisons suggest that there is adequate space within the Port of Oakland complex, including Port, City, and Union Pacific land, for the identified ancillary services to support projected cargo growth in all three scenarios.

Container Cargo Growth vs. Terminal Capacity. Exhibit 5 shows that the Port of Oakland would be at or near capacity under the moderate growth forecast and with estimated maximum terminal capacity under high productivity assumptions. If both Howard and Berths 20-21 were withdrawn from container cargo use, the port would be slightly over capacity by 2050. The slow growth forecast would leave Oakland at 70%-76% of capacity by 2050, while the strong growth forecast would exceed the port's estimated maximum capacity by 27% to 39%.

Exhibit 5: Container Cargo Growth Versus Terminal Capacity

Estimated Sustainable Capacity at:	Phase VI: High Productivity at all Terminals	2050 Moderate Growth TEU and Maximum Capacity Utilization		2050 Slow Growth TEU and Maximum Capacity Utilization		2050 Strong Growth TEU and Maximum Capacity Utilization	
815/803 Acres	5,625,797	5,187,588	92%	3,862,435	69%	7,038,560	125%
775/763 Acres w/o Howard	5,341,307	5,187,588	97%	3,862,435	72%	7,038,560	132%
795/783 Acres w/o Berths 20-21	5,483,552	5,187,588	95%	3,862,435	70%	7,038,560	128%
755/743 Acres w/o Howard or Berths 20-21	5,199,062	5,187,588	100%	3,862,435	74%	7,038,560	135%

To facilitate comparisons between cargo types, Exhibit 6 shows terminal acres needed and available under the maximum productivity assumption.

Exhibit 6: Container Cargo Growth and Acreage Requirements

Container Terminal Acres	2050 Acres Available	Moderate Growth		Slow Growth		Strong Growth	
		Required	Reserve	Required	Reserve	Required	Reserve
All Terminals	803	729	74	543	260	990	(187)
Without Howard	743	729	14	543	200	990	(247)
Without Berths 20-21	773	729	44	543	230	990	(217)
Without Howard or Berths 20-21	723	729	(6)	543	180	990	(267)

Berth Requirements. Container vessel size and the associated need for greater berth length are both increasing. The consultant team developed multiple scenarios for future vessel sizes and vessel calls, and checked their implications for berth length. Under a moderate growth scenario existing active berths could accommodate vessel growth through 2050, although some terminals would be berth-constrained on specific weekdays (also true of the slow growth scenario). Under the strong growth scenario Oakland would need additional berth capacity at either Howard or Berths 20-21. Howard's berth capacity may, however, be truncated in the process of expanding the Inner Harbor Turning Basin.

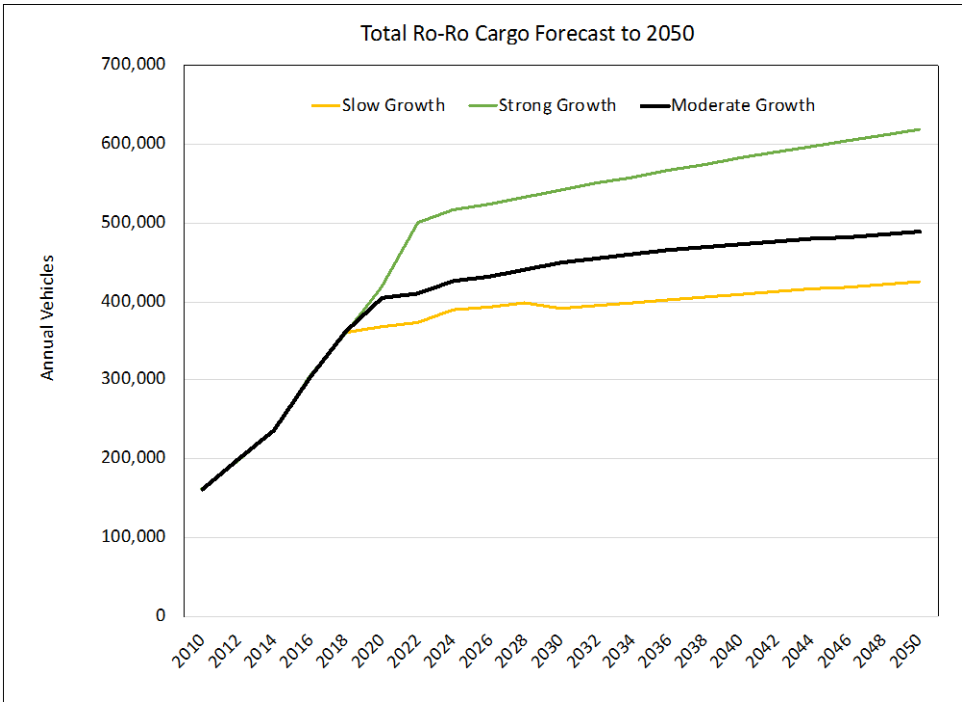
Ro-Ro (Neo-Bulk) Cargo

The Seaport Plan has used the term "neo-bulk" to describe cargos that are neither containerized nor bulk, but do not require the traditional piece-by-piece handling of break-bulk cargo. Roll-on roll-off (ro-ro) shipment of autos and other vehicles has come to dominate this cargo segment, and is the only active "neo-bulk" category at SF Bay

Area ports. The analysis therefore uses the "ro-ro" nomenclature for clarity and consistency with industry terminology.

The outlook for ro-ro cargo through San Francisco Bay depends on the growth in import and export auto volume, and on how many vehicles can be stored, processed, and moved through Bay Area facilities. The compound annual growth rate between 2019 and 2050 is projected to be 1.0 % in the moderate growth scenario, 0.5% in the slow growth scenario, and 1.8% in the strong growth scenario (Exhibit 7).

Exhibit 7: Ro-Ro Cargo Forecast to 2050



The Ports of Richmond, Benicia, and San Francisco are currently handling import and export autos in ro-ro vessels. Exhibit 8 shows that existing ro-ro terminals total about 215 acres, which compares closely to the estimate of 212 acres required under the team's base productivity estimates. This comparison is also consistent with the observations by port officials that the Richmond and Benicia terminals are operating at or near capacity at present.

Exhibit 8: Bay Area Ro-Ro Terminals and Scenario Capacities

Terminal	Acres	Low Capacity	Base Case Capacity	High Capacity
Annual Units per Acre		**1,371**	**1,700**	**2,173**
Existing	215	294,859	365,500	467,146
Benicia	75	102,858	127,500	162,958
Richmond Pt. Potrero	80	109,715	136,000	173,822
SF Pier 80	60	82,286	102,000	130,366
Potential	103	141,258	175,100	223,795
SF Pier 96	53	72,686	90,100	115,157
Oakland Howard Terminal	50	68,572	85,000	108,639
Total	**318**	**436,117**	**540,600**	**690,941**

The table in Exhibit 9 displays the combined ro-ro forecast and capacity analysis. Nine scenario combinations are presented. The moderate growth forecast and base case productivity scenario together suggest that 288 acres of

ro-ro terminal space would be required to handle 488,768 vehicles in 2050, and about 73 new acres of ro-ro terminal space would be needed. The slow growth scenario would require about 35 news acres with base case productivity. The strong growth forecast would require 148 acres of new space under the base case productivity, or 69 new acres with higher productivity.

Exhibit 9: Ro-Ro Cargo Summary

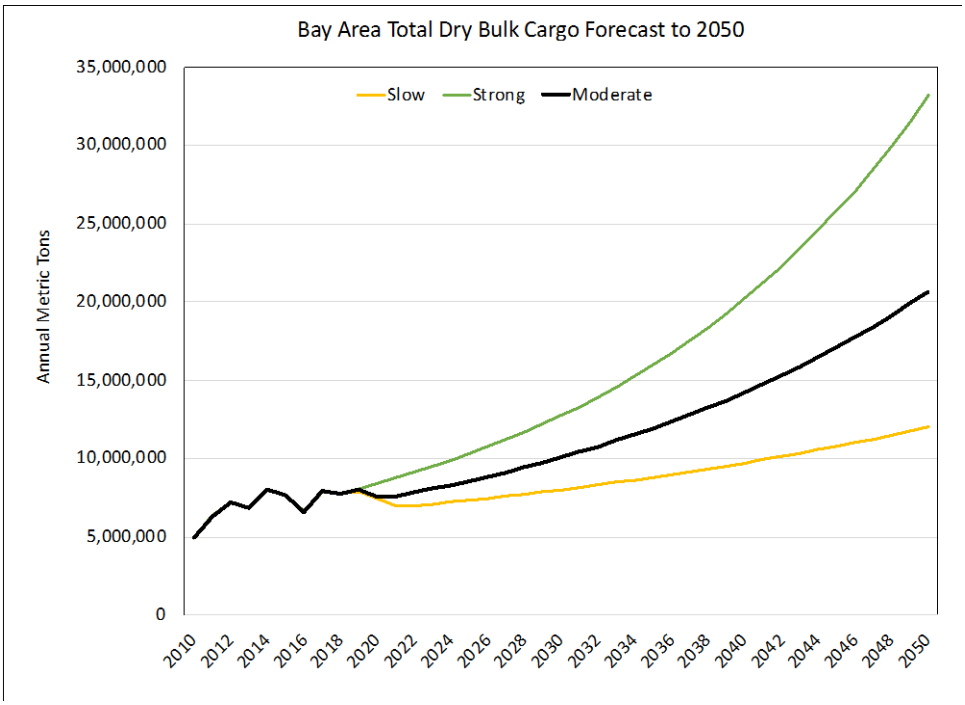
Scenario	2018	2020	2030	2040	2050	Existing Acres	New Acres	CAGR
Slow Growth	**360,671**	**368,207**	**390,388**	**409,298**	**424,892**			**0.5%**
Low Prod. Acres	212	224	285	298	310	215	95	1.2%
Base Prod. Acres	212	217	230	241	250	215	35	0.5%
High Prod. Acres	212	208	180	188	196	215	(19)	-0.3%
Moderate Growth	**360,671**	**404,607**	**448,696**	**472,768**	**488,768**			**1.0%**
Low Prod. Acres	212	247	327	345	356	215	141	1.7%
Base Prod. Acres	212	238	264	278	288	215	73	1.0%
High Prod. Acres	212	228	207	218	225	215	10	0.2%
Strong Growth	**360,671**	**418,831**	**541,505**	**582,249**	**617,923**			**1.8%**
Low Prod. Acres	212	255	395	425	451	215	236	2.5%
Base Prod. Acres	212	246	319	342	363	215	148	1.8%
High Prod. Acres	212	236	249	268	284	215	69	0.9%

Dry Bulk Cargo

The dry bulk import cargos handled through Bay Area ports have long been dominated by construction industry needs. The major commodities have included, and continue to include, aggregates (sand and gravel), bauxite and slag (used as concrete additives), and gypsum (used in wallboard). Outbound dry bulk cargos include scrap metal, petroleum coke (pet coke, a refinery by-product), and coal.

Dry Bulk Forecast. Exhibit 10 displays the combined tonnage forecast for dry bulk commodities, including imports, exports, and harvested bay sand. The main drivers are demand for sand and gravel and a dwindling regional supply, leading to increased imports.

Exhibit 10: Bay Area Total Dry Bulk Cargo Forecast, 2010-2050



Dry Bulk Capacity. The current (2012) Bay Area Seaport Plan includes a requirement of 13 acres for a dry bulk terminal and an average throughput capability of 1,037,000 metric tons per berth. The productivity forecast utilizes a spectrum of efficiency improvements that increase the number of metric tons handled per acre at varying rates by scenario, either by gradually introducing denser storage or by moving the product through the terminal and out to the customer faster. Exhibit 11 combines these productivity scenarios to estimate terminal requirements under moderate, slow, and strong growth forecasts. Moderate growth would likely require the equivalent of 34 additional acres and 3 additional berths.

Exhibit 11: Bay Area Estimated Dry Bulk Terminal Requirements for 2050

Factor	Existing	Moderate Growth	Slow Growth	Strong Growth
Annual Metric Tons	7,862,461	20,654,542	12,025,443	33,183,607
Tonnage increase	na	144%	47%	281%
Acres	**166**	**200**	**189**	**239**
MT/Acre	47,507	103,500	63,638	317,073
Acres per Terminal	13.8	13.8	13.4	14.9
Teminals	**12**	**15**	**14**	**16**
MT/Berth	655,205	1,423,120	846,103	2,402,750
Berths	**12**	**15**	**14**	**16**
New Acres		**34**	**23**	**73**
New Berths		**3**	**2**	**4**

Other Cargo Types

Bay Area Seaport facilities at Richmond continue to handle some non-refinery liquid bulk cargo including imported vegetable oils and chemicals. These are single-purpose terminals, however, and most are under private

ownership. Cargo movements may rise or fall on a commodity-by-commodity basis without strong long-term trends. Accordingly, the consultant did not analyze these flows or terminals in detail.

Some Bay Area seaport terminals previously handled break-bulk or project cargo. None handle such cargoes at present, and there is no specific projection for future demand. As the need for break-bulk or project cargo shipments (e.g. windmill parts) could arise in the future, there may be a purpose in maintaining break-bulk capability for the Bay Area, perhaps within container or ro-ro terminals.

Summary Findings

The Bay Area's seaports can expect long-term cargo growth in three sectors that could stress capacity: containerized cargo, ro-ro vehicle cargo, and import dry bulk cargo. There are three basic strategies for accommodating the expected growth: increased throughput at existing facilities; horizontal expansion onto vacant land or land in other uses within seaport complexes; and use of dormant marine terminals.

Increased throughput at existing terminals is generally the least costly, most efficient, and least disruptive means of accommodating growth. Terminal operators can be expected to expand throughput to the point at which the terminal becomes congested or when substantial capital investment is needed to increase capacity. At that point, economic and financial tradeoff will determine the preferred expansion path. Horizontal expansion onto available seaport land is often less costly and easier to implement than expansion via capital investment or existing footprints.

Exhibit 12 provides estimates of total seaport terminal acreage requirements under the three forecast scenarios. There are many possible variations. The three cargo types will not necessarily follow similar growth scenarios, although all will be affected by the same underlying regional economic growth trends. Also, different terminals may follow different productivity strategies. The general implication of Exhibit 12, however, is clear:

- Under moderate cargo growth assumptions the Bay Area will need more active terminal space, estimated at about 271 acres by 2050.
- Under slow cargo growth assumptions the Bay Area will need about 36 acres more active terminal space by 2050.
- Under strong growth across the three cargo types, the Bay Area will need substantially more seaport terminal space, about 646 more acres than is now active (and will need to activate additional berth space for larger container vessels).

Exhibit 12: Estimated Seaport Acreage Requirements

Forecast Scenario	Container Cargo Terminal Acres			Ro-Ro Cargo Terminal Acres			Dry Bulk Cargo Terminal Acres			Combined Cargo Terminal Acres		
	Existing*	2050**	Additonal	Existing	2050***	Additonal	Existing	2050***	Additonal	Existing	2050	Additonal
Moderate Growth	565	729	164	215	288	73	166	200	34	946	1,216	271
Slow Growth	565	543	(22)	215	250	35	166	189	23	946	982	36
Strong Growth	565	990	425	215	363	148	166	239	73	946	1,592	646

* In-use Acreage at Port of Oakland

** At maximum mainstream productivity

** *Under base productivity assumptions

Available Terminal Expansion Sites

Within the Bay Area seaports there are a few dormant or under-utilized terminal sites.

- San Francisco's Pier 96, formerly part of the Pier 94–96 container terminal, is currently partially vacant and partially in non-cargo uses.
- Oakland's Berth 20-21area is used for ancillary services at present, although there is an active proposal to develop a dry bulk terminal there.
- Oakland's Berth 22-24 area, formerly part of the Ports America complex, is currently used for ancillary port functions.
- Oakland's Howard Terminal is also currently used for ancillary services.
- Oakland's Roundhouse parcel, although not on the water, is adjacent to active container terminals.
- Richmond's Terminal 3, formerly a small container terminal, is currently being used to load logs into containers for export through Oakland, but is not handling any cargo over the wharf.

Exhibit 13 lists these sites, their size, and their potential uses. The table also illustrates some inherent tradeoffs.

Exhibit 13: Bay Area Seaport Expansion Sites

Site	Acres	Potential Use		
		Container	Ro-Ro	Dry Bulk
SF Pier 96	50		X	X
Oakland Berths 20-21	23	X		X
Oakland Berths 22-24	130	X		
Oakland Berths 33-34	20	X		
Oakland Roundhouse	39	X		
Oakland Howard*	38	X	X	X
Richmond Terminal 3	20		X	X
Available Acres	**320**	**189-250**	**0-108**	**0-131**
Moderate Growth Needs	271	164	73	34
Slow Growth Needs	36	-22	35	23
Strong Growth Needs	646	425	148	73

* Post turning basin expansion

- San Francisco's Pier 96 was most recently used to handle containers. Its limited draft, however, would make it less suitable for container handling than the Oakland locations. Moreover, the container shipping industry previously consolidated at the Oakland terminals, and an isolated terminal across the Bay at San Francisco is unlikely to be attractive to container shipping lines in the future. Pier 96 also lacks access to active rail intermodal facilities. Trucks connecting Pier 96 with inland customers would add to congestion on the bay bridges. Pier 96 would therefore most likely be suitable for ro-ro or dry bulk cargos.
- Oakland's Berth 22-24 site is expected to be used for container cargo in the long run. The consultant team's analysis suggests that the Berth 22–24 capacity will be required under any container forecast scenario, and there have been no proposals to use this space for other cargos.

- Oakland’s Berths 20-21 may be used for dry bulk cargo, either as an interim use or in the long term. If so, available container berth space would be reduced as well, increasing the need to either boost productivity or expand container operations to Howard Terminal.
- Oakland's Roundhouse site has no berth access, and can only function as added space for adjacent container terminals.
- Oakland’s Howard Terminal capacity may be required for container handling under the forecast scenarios, depending on what degree of other productivity improvement is implemented at other terminals. In addition to its terminal acreage, Howard's berth capacity may be required to handle larger vessels or additional services under a strong growth scenario, particularly if Berths 20-21 are used for dry bulk cargo. Howard Terminal may also be a logical expansion site for ro-ro vehicle handling. Howard has handled ro-ro vehicles in the past, and is the closest marine terminal to Tesla’s Fremont assembly plant. Howard could also handle dry bulk cargo under some circumstances, and Schnitzer Steel has expressed interest in using a portion of Howard to expand its adjacent operations.
- Richmond’s Terminal 3 has limited space, as the terminal totals about 20 acres. With such limited backland, 35’ of draft, and isolation from the Oakland terminals, T3 is not a viable location for container handling. T3 would most likely serve as auxiliary parking for the Pt. Potrero ro-ro terminal. It could also handle dry bulk cargos.

As Exhibit 13 indicates, moderate container cargo growth through 2050 could probably be handled at Oakland without Howard Terminal or Berths 20-21, but as Exhibit 5 shows Oakland would have little or no room for future growth. Strong container cargo growth would exhaust Oakland's total capacity unless terminals can boost productivity to higher levels than anticipated.

The Bay Area could probably meet moderate ro-ro cargo growth needs at SF Pier 96 and Richmond's Terminal 3, but strong growth would introduce a conflicting demand for Howard Terminal's acreage.

Dry cargo growth may conflict with the availability of SF Pier 96, Oakland's Berth 20-21, or Howard Terminal for ro-ro or container cargo.